Notes on Some Pleopeltis and Polypodium Species of the Chihuahuan Desert Region

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In preparing a treatment of the Polypodiaceae *s. str.* for the forthcoming Chihuahuan Desert Flora (M. C. Johnston, et al.), I found several taxonomic changes to be necessary. A new variety of *Polypodium thyssanolepis* A. Br. ex Kl. is described, and *Pleopeltis erythrolepis* (Weath.) Pic. Ser. is lowered to varietal rank within *Pleopeltis polylepis* (Roem. ex Kunze) Moore. Material from GH, LL, NY, TEX, and US was consulted in preparation of the treatment.

POLYPODIUM

Polypodium thyssanolepis A. Br. ex Kl. is a species of lithophilic fern which ranges from the southwestern United States to South America and the West Indies. Originally described from Colombian material (Klotzsch, 1847), it was not reported from the United States until 1913, when Maxon noted it among the collections of L. N. Goodding from the Huachuca Mountains of southeastern Arizona. Maxon (1913) stated that Goodding's specimens were "perfectly typical of the species as it exists from Mexico to the Andes and in Jamaica." In his revision of several groups of squamate American polypodies (Maxon, 1916), the most recent revision in which *P. thyssanolepis* has been treated, he recognized no varieties within the species. However, in recording the species from Texas, Maxon (1923) noted that specimens from both Texas and Arizona "have fronds only scantily scaly beneath, in marked contrast to tropical material."

A number of characters are correlated with the sparser indument of the fronds of these northern populations. Material from western Texas, southeastern Arizona, northern Coahuila, and parts of Chihuahua appears to represent a strongly marked new variety of *P. thyssanolepis* (Fig. 1). None of the synonyms of *P. thyssanolepis* (see Maxon, 1916; Morton, 1973) refer to this new variety, which may be distinguished from the typical variety by the following key:

Stipes sparsley scaly, the scales mostly ovate or lance-ovate, suborbicular scales few or none; scaly indument of the lower lamina surface not so dense as to obscure the surface; venation mostly free, with fewer than 30%(40%) of the sori within areoles; basal lobes of the lamina distinctly alternate. ..... *P. thyssanolepis* var. *riograndense*

Stipes densely scaly, the scales mostly suborbicular; scaly indument of the lower lamina surface dense, typically entirely obscuring the surface; venation mostly areolate, with more than 70% (usually nearly 100%) of the sori within areoles; basal lobes of the lamina opposite or subopposite. *P. thyssanolepis* var. *thyssanolepis*

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Polypodium thyssanolepis var. riograndense Wendt, var. nov.

A var. *thyssanolepide* stipitibus multo minus squamatis squamis suborbicularis paucis vel absentibus, laminis minus squamatis, venatione libera pro parte maxima, et positione lobarum laminarum basilarium distincte alterna recedit.

Small lithophilic ferns. Rhizome slender, wide-creeping, 1.5–2.5 mm thick, densely scaly; rhizome scales subulate to lanceolate-acuminate, (1.0) 1.5–3.0 mm long, imbricate, light brown with a darker central stripe composed of dark-walled cells with clear lumina, the margins slightly erose to irregularly ciliate. Fronds distant or occasionally a few somewhat crowded, to 15(20) cm tall, usually much smaller; stipes usually slightly shorter than to slightly longer than the laminae, but varying from one-half to twice as long, sparsely scaly, the scales mostly subulate to lanceolate-acuminate, peltate, to 3 mm long, erose to fimbriate, the larger ones usually brown with a blackish central stripe, these scales often continuing into the lower part of the rachis, with nearly orbicular, irregular, peltate scales scattered or absent; laminae oblong or ovate to triangular-oblong to deltate, to 10 cm long, to 5.5 cm wide, acuminate or acute, deeply pinnatifid into up to 9(11) segments on each side (usually fewer), glabrous above, sparsely to moderately densely scaly below but the scales usually not completely obscuring the green of the surface, the lamina scales peltate, ovate to lanceolate, usually attenuate-acuminate, 0.8–2.0(3.0) mm long, light reddish-brown, darker at the point of attachment, weathering gray, the margin remotely toothed to lacinate, orbicular scales few or none, the lobes distant to fairly close, linear or spatulate to oblong, entire, obtuse to broadly acute, regular or irregular in length on the same frond, perpendicular or slightly ascending relative to rachis, the lowest pair distinctly alternate, venation mostly free, fewer than one-half of the sori (usually many fewer) within areoles; sori roundish, in a single row on each side of midvein of lobe, usually obscured by scales; spores 64 per sporangium.

TYPE: Uncommon in crevices of cliffs and boulders in sheltered canyon with *Quercus grisea, Juniperus* sp., *Ungnadia speciosa, Garrya ovata*, etc., lower Indian Cave Canyon (side canyon of Dead Horse Canyon), north side of Chinati Mountains, Presidio Co., Texas, 16 Oct 1977, *M. L. Butterwick & E. J. Lott 3897* (TEX; isotypes GH, MEXU).

Polypodium thyssanolepis has generally been characterized as having areolate venation and pinnatifid fronds (Maxon, 1916). A rare form of the species with bipinnatifid fronds is known to show partial loss of areolation; this form occurs with the normal form in Central America (Maxon, 1916), but is not known from northern Mexico or the United States. It agrees in density of indument and all other characters with typical var. *thyssanolepis*. On the other hand, the new variety differs strongly and consistently from var. *thyssanolepis* in venation (*Fig. 2*). These venation characters are constant regardless of size; occasional specimens of var. *thyssanolepis* from Chihuahua in which the fronds are much reduced (laminae as small as 0.5 cm long), with many fronds nearly entire, nevertheless display the areolate venation (and all other characters) typical of much larger tropical plants of the variety. South American material, including all specimens seen from Colombia (at GH), the type locality of the species, agrees with var. *thyssanolepis* as here circumscribed.

Fronds of var. *thyssanolepis* may reach much larger sizes (to 60 cm or more) than those of var. *riograndense*, but this probably is a direct environmental effect.

Specimens of var. *thyssanolepis* from northern Mexico are generally much smaller than tropical material; indeed, the reduction found in certain Chihuahuan specimens, noted above, is unparalleled in var. *riograndense*.

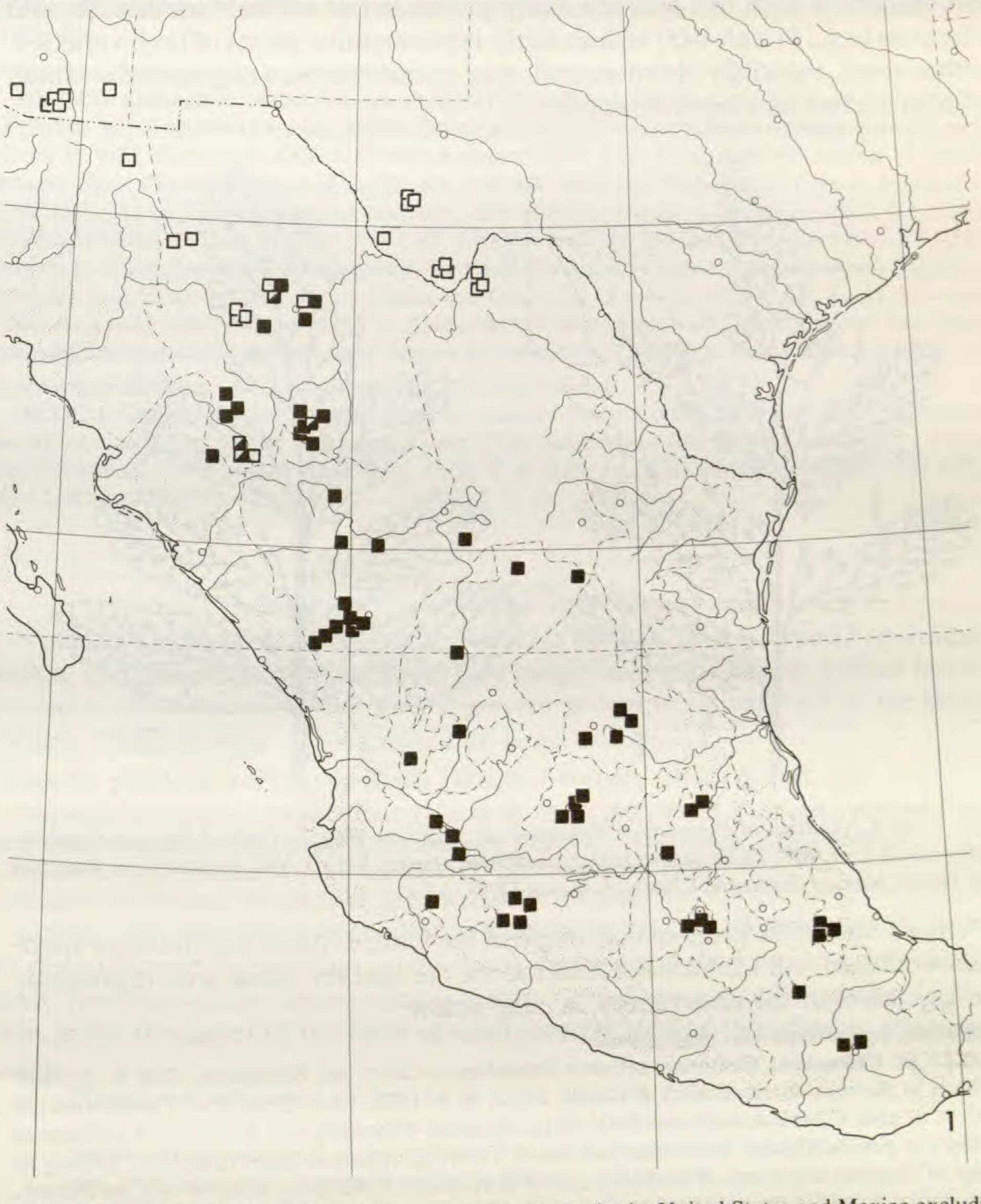
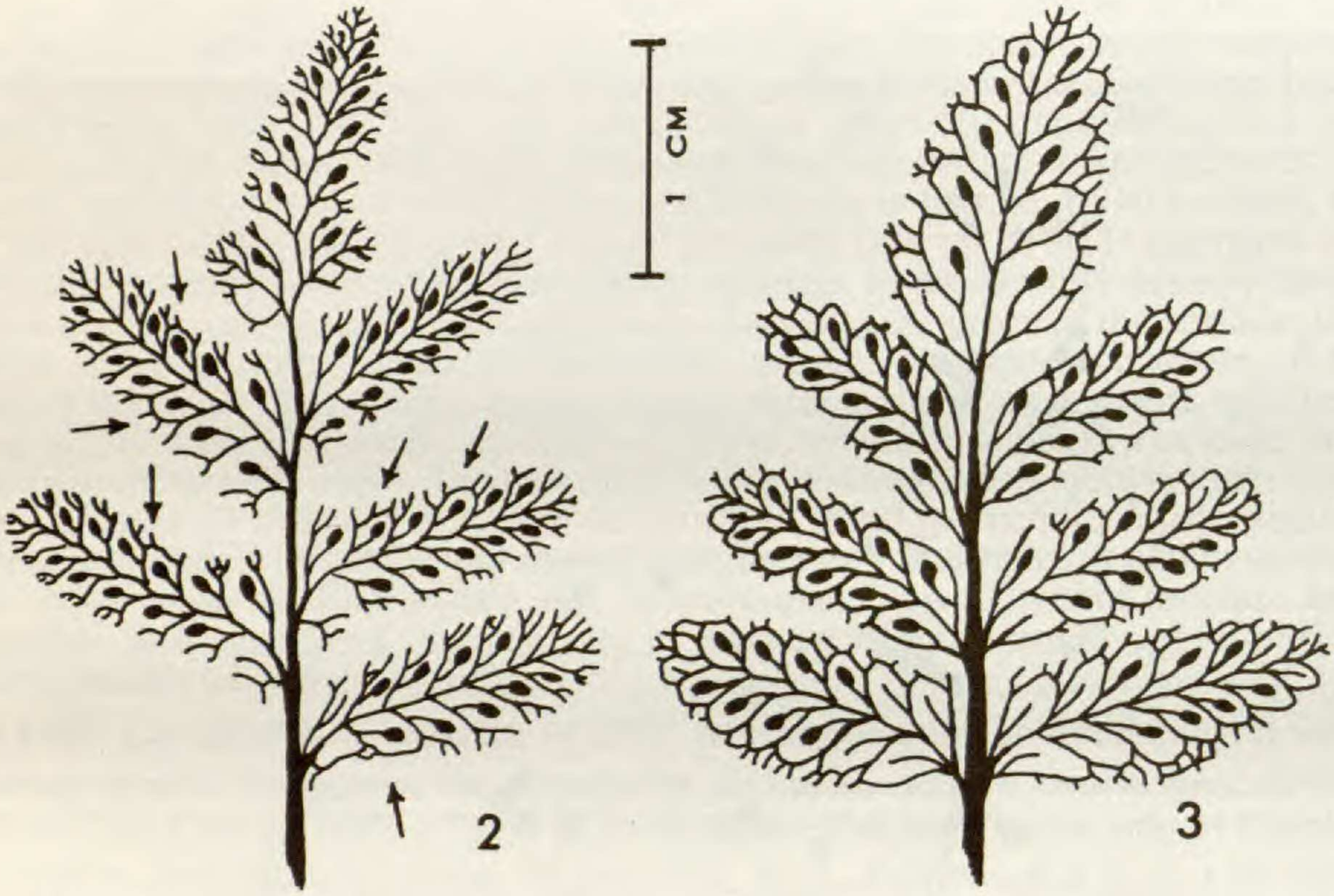


FIG. 1. Distribution of *Polypodium thyssanolepis* varieties in the United States and Mexico excluding Chiapas. Black squares = var. *thyssanolepis;* open squares = var. *riograndense;* half-squares = intermediates.

The chromosome number of *P. thyssanolepis* var. *thyssanolepis* has been reported as $n=37$ from South American material (Evans, 1963) and $n=74$ from a Jamaican population (Wagner & Wagner, 1975). *Polypodium thyssanolepis* (vari-

ety unknown) has been reported as n=ca. 72 from material from "Mexico" (Sorsa in Fabbri, 1965; Sorsa, 1966).

A limited number of varietal intermediates is found in Chihuahua (*Fig. 1*), but most specimens from this area are easily placed in one of the varieties. Several collections (e.g., *Pringle 443*) include fairly representative plants of both varieties. Further work, especially chromosomal, may reveal that var. *riograndense* would be better treated as a separate species.



FIGS. 2 and 3. Venation of *Polypodium thyssanolepis* varieties. FIG. 2. Type of var. *riograndense* (*Butterwick & Lott 3897*, TEX); arrows indicate scattered areoles. FIG. 3. Var. *thyssanolepis* from San Luis Potosí, Mexico (*Johnston, Chiang & Wendt 12275*, LL).

Figure 1 shows the geographical origin of the United States and Mexican specimens examined. All Chihuahuan material for the species, along with representative specimens of the new variety, is cited below.

Polypodium thyssanolepis var. riograndense:

MEXICO: Chihuahua: Mountains between Guadalupe y Calvo and Nabogame, 7200 ft, on large boulders in pine-oak forest, *Correll & Gentry 23052, p. p.* (GH, LL); 12 mi W of Cuauhtémoc, in crevices of cliff, *Correll & Johnston 21610* (LL); Between Yepomera and Babicora, in crevices of boulders in pine-oak-juniper open mountain forest, *Correll & Johnston 21624* (LL, US); Vicinity of village of Majalca, in crevices of boulders, *Correll & Johnston 21780* (LL); 12 mi W of Cuauhtémoc, steep, rocky (granitic) slope, in pinyon pine-scrub oak association, *Gould 8958* (LL); Río Negro and vicinity, *LeSueur 1273* (TEX); Rocky hills near Chihuahua, cold cliffs, *Pringle 443, p. p.* (GH, NY, US); 16 mi W of Cuauhtémoc, rolling terrain with scattered junipers, pinyons, and oaks, 7200 ft, in rocky crevices on a steep slope, *Reeder, Reeder, & Soderstrom 3477* (GH). **Coahuila:** Sierra del Jardín, Canyon Hundido on N side of Pico Centinela, 8 km E of Rancho El Jardín by winding road, 1500-2250 m, steep canyon through igneous sierra, *Johnston, Chiang, Wendt & Riskind 11803A* (LL). **Sonora:** Loop of the Río de Bavispe, S of Aribabi, Sierra de Huépari, 1495 m, *Harvey 1706* (US).

UNITED STATES: Arizona: Cochise Co.: Conservatory Canyon, Huachuca Mts., July–Sept 1882, *Lemmon s. n.* (GH, NY, US); Chiricahua Mts., *Peebles & Loomis 5415* (US). Pima Co.: Baboquivari Mts., *Gilman 15* (US). Santa Cruz Co.: Sycamore Canyon, Patagonia Mts., 2800 ft, *Ripley & Barneby 2822* (NY). **Texas:** Brewster Co.: Chisos Mts., Boot Spring, 30 June 1932, *Mueller s. n.* (GH, NY, TEX). Jeff Davis Co.: Near Fort Davis, in clefts and crevices of porphyritic rocks, *E. J. Palmer 32196* (TEX, US).

Polypodium thyssanolepis var. thyssanolepis:

MEXICO: Chihuahua: Minas Nuevas, ca. 8 mi NW of Parral, 6000 ft, *Correll & Gentry 22764* (GH, LL, US); Ca. 5.5 mi NW of Parral, 5800 ft, *Correll & Gentry 22723* (LL); Sierra de Santa Barbara, ca. 4 mi SW of Villa Matamoras, 6300 ft, *Correll & Gentry 22802* (NY, LL); Along old railroad W toward Rancho Ojito, *Correll & Johnston 21488* (LL, NY); 25 mi SE of Cuauhtémoc, *Correll & Johnston 21597* (LL); 11 mi S of Matamoras (Cuevas), 1950–2100 m, *Gentry & Arguelles 18037* (LL, US); Majalca (Pilares), 2075 m, *Harvey 1463* (GH, US); La Bufa, on Río Batopilas, *Knobloch 578* (US); Canyon E of Hidalgo de Parral, *Knobloch 751* (US); Cerocahui–Cuiteco Road, *Knobloch 882* (US); Barranca Guerachic, between Agua Blanca and Guerachic, *Knobloch 1849* (LL); Rocky hills near Chihuahua, cold cliffs, *Pringle 443, p. p.* (GH); Potrero Peak, *Pringle 977* (NY); Between San Francisco del Oro and Santa Barbara, near Arroyo de Granadeña, ca. 7000 ft, *Soderstrom 894* (LL).

Intermediates between var. thyssanolepis and var. riograndense:

MEXICO: Chihuahua: Small mountain on NE edge of Parral, *Correll 22688* (GH, LL); Mountains just SE of Nabogame, 6000 ft, *Correll & Gentry 23033* (LL); Mountains between Guadalupe y Calvo and Nabogame, 7200 ft, *Correll & Gentry 23052, p. p.* (GH, LL, US); Majalca, *Knobloch 329* (GH, US), *LeSueur 476* (US).

PLEOPELTIS

A study of material of *Pleopeltis erythrolepis* (Weath.) Pic. Ser. and *P. polylepis* (Roem. ex Kunze) Moore throughout their ranges in Mexico and the United States has led to the conclusion that they represent geographical varieties of the same species. The following new combination is necessary:

Pleopeltis polylepis var. erythrolepis (Weath.) Wendt, comb. & stat. nov.

Polypodium erythrolepis Weath. Contr. Gray Herb. 65:11. 1922. TYPE: Cold cliffs, Portrero [Potrero] Peak, Chihuahua, *Pringle 825* (GH!; isotypes, GH!, LL!, NY-2 sheets!, US-3 sheets!).

Phlebodium erythrolepis (Weath.) Conzatti, Fl. Tax. Mex. 1:95. 1946.

Pleopeltis erythrolepis (Weath.) Pic. Ser., Webbia 23:189. 1968.

Various characters have been used to distinguish the taxa. Weatherby (1922), in his description of *Polypodium erythrolepis*, emphasized the long stipe and imbricated, fimbriate-ciliate lamina scales of this "well-distinguished" species. However, in his treatment of the ferns of north-central Mexico (Weatherby, 1943) he states:

> [These new collections] go very far to break down the differences between *P. erythrolepis* and *P. peltatum* [*Pleopeltis polylepis*]. In them, the abundant, ovate, deeply lacerate-margined scales of the former, which seemed so distinctive when it was proposed, nearly disappear and are replaced by suborbicular ones. The surviving distinctions are: *P. erythrolepis,* stipe nearly as long as the blade, costa green on the lower surface; *P. peltatum*, stipe conspicuously shorter than the blade, costa black on lower surface. In addition, *P. erythrolepis* tends to have narrower rhizome-scales with narrower, more definitely erose-serrulate hyaline margins; but this is only a tendency. Furthermore, the collection here cited under *P. peltatum* . . . is also transitional . . . In all probability, *P. erythrolepis* would best be treated as a variety of *P. peltatum*.

Knobloch and Correll (1962) "more or less avoided the taxonomic issue by recognizing as *P. peltatum* those plants that have a distinctly blackish costa and placing those plants that lack this characteristic into *P. erythrolepis*," and in doing so recognized both species from Chihuahua.

In the present study it was found that both costa color and stipe length are too variable within both taxa to be taxonomically useful. The characters for distinguishing the varieties are given in the following key:

Scales of the lower surface of mature laminae entire or merely erose, mostly orbicular, usually not densely imbricate; rhizome scales ovate to broadly lanceolate.....*P. polylepis* var. *polylepis*

Scales of the lower surface of mature laminae fimbriate or ciliate and/or mostly acuminate, usually densely imbricate; rhizome scales lanceolate-acuminate to broadly lanceolate.

P. polylepis var. *erythrolepis*

Populations from Sonora, Chihuahua, northern Durango, and Texas fit easily within var. *erythrolepis* as here circumscribed, and almost all central and southern Mexican populations (southern Durango and Guanajuato south to Oaxaca, also Baja California Sur) are "good" var. *polylepis*. However, a broad range of intergradation between the varieties occurs in the northern Sierra Madre Oriental of southern Coahuila, Nuevo León, and San Luis Potosí, where individuals referable to both varieties as well as a preponderance of intermediates occur. Furthermore, northern Coahuilan populations (Muzquiz to Sierra del Carmen) include many intermediate types in additon to those referable to var. *erythrolepis*.

The problem is compounded not only by intrapopulational variation in lamina scales, but also by the fact that scaliness of the fronds changes with age. Young fronds of all populations tend to have many acuminate scales; these are then apparently shed quite early in the case of var. *polylepis*, but are retained much longer in var. *erythrolepis*. Mature, preferably fertile fronds therefore are necessary for specimen identification.

Only one glaring exception to the above-mentioned geographical pattern was found in the material studied. A specimen from the state of Mexico (Parque Nacional de Laguna Zimpoala, *Barkley, Webster & Rowell 7420*, TEX) is referable by all characters to var. *erythrolepis*, although it is well south of the range of that variety.

There also appears to be some problem in the differentiation of *Pleopeltis polylepis* var. *polylepis* from *P. macrocarpa* var. *trichophora* (Weath.) Pic. Ser. in central Mexico, particularly in the general area of Mexico City. The taxonomic problems involving *P. polylepis* and *P. macrocarpa* are emphasized by the fact that a variety originally described by Weatherby (1944) within *P. polylepis* (as *Polypodium peltatum* var. *interjectum*) appears to belong closer to *Pleopeltis macrocarpa* (A. R. Smith, pers. comm.). Further studies are much needed in this complex.

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REVIEW

"THE EXPERIMENTAL BIOLOGY OF FERNS," by A. F. Dyer (ed.). Experimental Botany: An International Series of Monographs, vol. 14, 657 pp. 1979. Academic Press, London and New York, ISBN 0-12-226350-2. $79.00—Over the past forty years a significant amount of research has been devoted to the experimental biology of pteridophytes. Although information has accumulated and developmental and genetic problems have been better circumscribed, there has been no attempt to organize this into a fashion which would make the relevant ideas and literature easily available to experimental biologists and botanists. This volume attempts to review comprehensively nearly all of the significant studies in fern experimental biology in a context which stresses the controversies currently extant and the problems and avenues of approach which promise to provide the most productive and interesting rewards. In essence, it is a technical introduction to the literature, with over 2000 reference citations. The textual contents reflect accurately the current state of knowledge with heavy emphasis on morphogenetic studies of the gametophyte generation. The 16 chapters, contributed by 16 authors, detail our knowledge of meiosis; spore initiation, morphogenesis, and germination; structural, physiological, and biochemical aspects of the filamentous gametophytic stage; differentiation from one-dimensional to two-dimensional growth; antheridiogens; sporophyte development; apogamy, genetics, cytogenetics, and hybridization; and experimental ecology. Although many of the contributions are excellent, some are superficial, reflecting in my estimation the lack of experimental studies in those fields. However, because of the comprehensive literature surveys and the emphasis on ideas and problems, this volume will be a very valuable source book for experimental biologists and pteridologists for many years to come.—*Robert M. Lloyd, Department of Botany, Ohio University, Athens, OH 45701.*